



## NEW ZEALAND JOURNAL OF ARCHAEOLOGY



This document is made available by The New Zealand Archaeological Association under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

To view a copy of this license, visit  
<http://creativecommons.org/licenses/by-nc-sa/4.0/>.

# Archaeology of Borchgrevink's Stores Hut, Cape Adare, Antarctica

David L. Harrowfield  
DSIR Antarctic, Christchurch

## ABSTRACT

In 1990, a new cladding was fitted to the roof of Borchgrevink's 'living hut' and the contents of the 'stores hut' were excavated. Artefacts were preserved as a result of snow accumulating in the unroofed structure. Data obtained from the excavation support use of the storage hut for temporary accommodation by members of an expedition which wintered at Cape Adare in 1911. Improved sleeping platforms and evidence for partitioning and heating of the hut were found.

*Key words:* ANTARCTICA, CAPE ADARE, RIDLEY BEACH, HISTORICAL ARCHAEOLOGY, ARTEFACTS, BORCHGREVINK, CAMPBELL, STORES HUT.

## INTRODUCTION

In 1899, ten men of C. E. Borchgrevink's British Antarctic (*Southern Cross*) Expedition 1898–1900 established themselves on Ridley Beach, Cape Adare, in Northern Victoria Land. Two Norwegian prefabricated huts were erected for accommodation and stores. Before the departure of the expedition a year later, when a second winter-over elsewhere was contemplated, the roof was removed from the stores hut which contained a quantity of provisions and equipment.

On the arrival in 1911 of the Northern Party of R. F. Scott's British Antarctic (*Terra Nova*) Expedition 1910–1913, the stores hut was used for temporary habitation and storage. After their departure the following January, Ridley Beach received no visitors for 44 years. When the next party arrived in 1956, the living hut was found to be full of ice and the stores hut contained cases of supplies and other artefacts.

The first New Zealand field party camped on Ridley Beach in 1961 and cleared ice from the living hut. Subsequent parties in 1973 and 1982 partially examined the frozen contents of the stores hut. In January 1990, the stores hut was excavated, recording artefacts and stratigraphy, to ascertain the condition of the building for possible future restoration, and to provide storage for the bow of a whale boat and other artefacts.

## THE SETTING

Ridley Beach is a triangular-shaped, 73 ha, cusped foreland at the north-west end of Cape Adare on the Adare Peninsula (Fig. 1). The foreland consists of two suites of gravel beach ridges. An older set is orientated sub-parallel to South Beach and is up to 6 m above sea level. Low-lying swales contain lagoons fed by melt water streams of stagnant water. The second set of ridges is orientated at right angles to the first and is aligned sub-parallel to North Beach (Mabin 1982). The largest Antarctic Adelie penguin rookery, with an estimated 282,300 breeding pairs in 1986 (Taylor *et al.* 1990), occupies most of the foreland, which

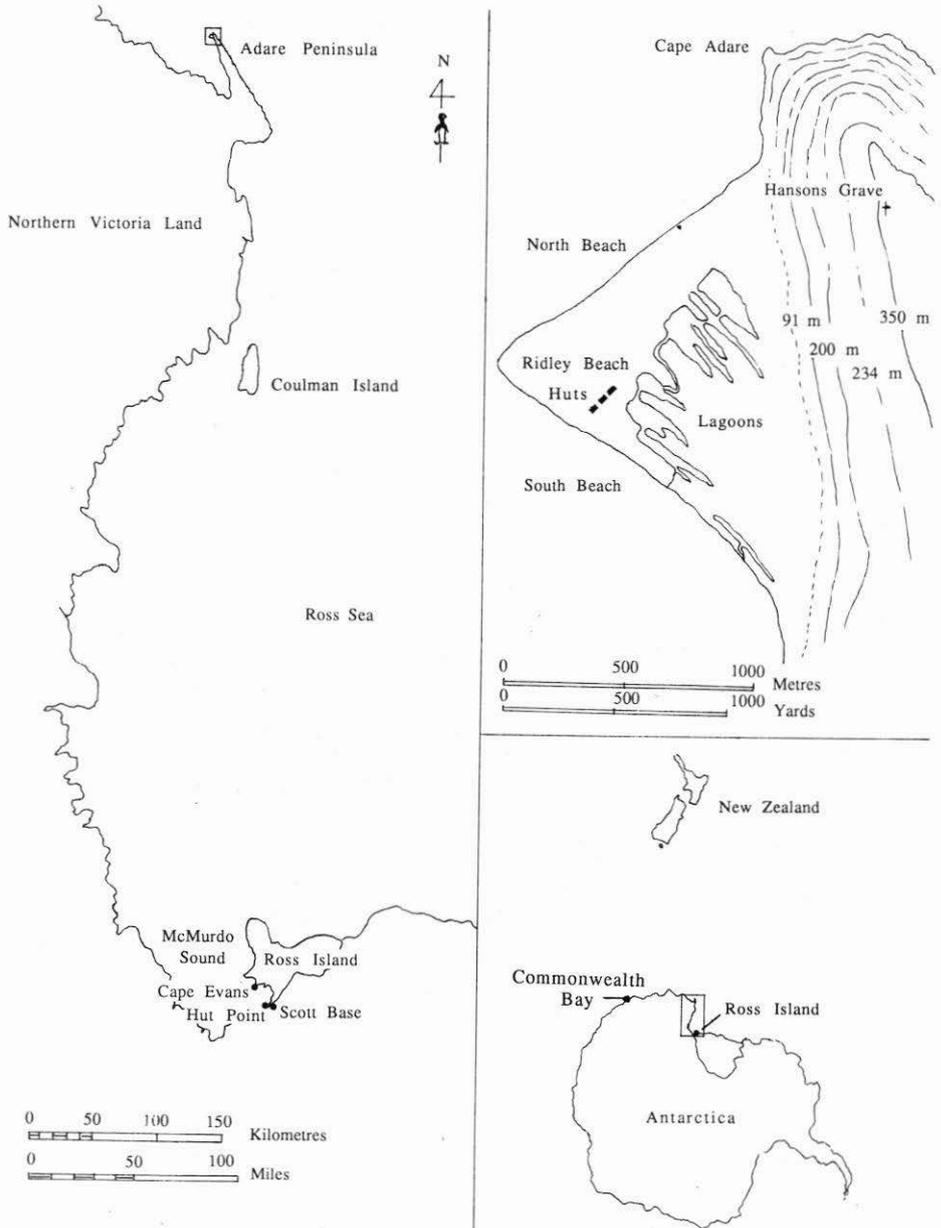


Figure 1: Ridley Beach, Cape Adare with location of historic site.

backs on to a protalus rampart below steep cliffs rising to 350 m. These cliffs, formed from Cenozoic basalt flows and tuffs, have an important influence on local weather, particularly during east-south-east storms, which in autumn and winter reach hurricane force. During southerly storms, the historic site, which is only 40–50 m from South Beach, is swept with salt spray. This has been very detrimental to metal artefacts in particular. In summer, frequent light snow falls occur; temperatures range from  $-5^{\circ}\text{C}$  to  $+15^{\circ}\text{C}$  and relative humidities from 70 to 100%. On occasions, light rain has been recorded.

## HISTORICAL BACKGROUND

Cape Adare is steeped in history. The first recorded landing on the continent proper was made here from the whaling ship *Antarctic* on 24 January 1895. Four years later, when Borchgrevink's expedition arrived, two wooden huts were built for the first winter-over on land (Fig. 2). Supplies and construction materials were brought ashore in the ship's boats. These were pulled along a hawser from the ship to the shore and the supplies were then carried through the surf to the beach. Construction began immediately. After excavating to a depth of 60 cm for foundations, the 5 x 5 m huts were erected. Numbered, 160 x 85 mm, interlocking boards of 40- to 50-year-old Norway spruce (*Picea abies*) had steel rods inserted vertically through them to make the walls rigid. The huts were placed approximately 4 m apart, and linked by wooden beams covered with canvas and Weddell seal skins (Borchgrevink 1901).

The stores hut, a simple uninsulated structure of one board thickness, was used almost exclusively for provisions and spare clothing (Bernacchi 1901). However, a few days before the death of 28-year-old Norwegian biologist, Nicolai Hanson, on 14 October 1899, the hut provided accommodation for some members of the shore party. Others were in a tent erected nearby. Hanson, at his own request, was buried on top of Cape Adare above Ridley Beach.



*Figure 2:* Huts of the British Antarctic Expedition, erected in 1899 and 1911, photographed in February 1990. Left to Right: remains of Northern Party Hut 1911, Borchgrevink's living hut and stores hut. In foreground are roof trusses from stores hut and two barrels from the 1899 expedition.

TABLE 1  
LIST OF PROVISIONS LEFT AT CAPE ADARE IN FEBRUARY 1900  
(after Borchgrevink 1901)

Commodity	Barrels	Cases	Tins
Flour (crew and cabin)	4	-	150 about
Flour (Hungarian, in tins)	-	4	-
Rice (Patna)	-	4	-
Barley	-	2	-
Oatmeal	-	1	8
Biscuits (Cabin)	-	1	-
Butter	-	4	-
Lard	-	4	-
Cheese	-	2	-
Milk (Cocoa, chocolate, coffee)	-	6	-
Tea	-	3	70 about
Meat - cocoa	-	1	-
Boiled beef	-	10	-
Tripe	-	1	-
Army rations	-	-	50 about
Salted meat	1	-	-
Oxine extract	-	1	-
Beef suet	-	1	-
Bacon in tins	-	1	-
Haddocks	-	1	Several
Sardines	-	-	Several
Herrings	-	-	Several
Potatoes (dried, in tins)	-	3	Several
Potatoes (fresh, in tins)	-	-	Some
Herbs (dried)	-	-	Several
Vegetables (dried, in tins)	-	3	-
Vegetables (fresh, in tins)	-	-	Some
Salt (table)	-	3	-
Frame food (jelly)	-	6	-
Frame food (extract)	-	2	-
Frame food (tablets)	-	1	-
Jams	-	1	-
Prunes	-	1	-
Marmalade	-	-	50 about
Jelly crystals	-	3	-
Pickles	3	-	100 bottles
Chutney	-	-	100 bottles
Sauce	-	-	100 bottles
Curry powder	-	1	Several
Pepper	-	-	Several
Mustard	-	-	Several
Coal (in bags) about 10 tons	-	-	-

Along the east wall of both buildings the roof line was extended to the ground with a lean-to of timber covered with canvas and seal skins, and weighted down with bags of coal. The lean-to provided additional all-weather storage for provisions and fuel.

When the expedition departed on 2 February 1900, 71 cases and numerous barrels of provisions and other supplies, including ammunition, lighting oil, and 10 tons of coal judged to be sufficient for one year, were left on Ridley Beach (Table 1). The stores hut was partially dismantled by removal of the roof when a second winter was contemplated near Coulman Island in preparation for a journey to try and locate the South Magnetic Pole. Within hours of sailing, the idea of another winter in Antarctica was abandoned and the stores hut was left to the elements (Colbeck 1903).

On 2 January 1902, a party from the *S.Y. Discovery* of Scott's National Antarctic (*Discovery*) Expedition 1901–1904 landed on Ridley Beach to undertake magnetic observations. Edward Wilson recorded that

The litter around the huts was very interesting and the waste excessive. Ski, Canadian snowshoes, bamboo poles, dead dogs, seals, bundles of birds, penguins and provisions all mixed up in a horrible confusion and the huts looked like the centre of a rubbish heap. (Wilson 1966)

Nearly a decade later, when the six members of the Northern Party led by V. L. A. Campbell landed, the severity of the climate had taken its toll. F. E. C. Davies, the *Terra*



Figure 3: Southeast corner, stores hut, 1961. Note utensils on left. NZARP Antarctic expedition items on improvised table, rear right. Chair is from Northern Party 1911.

*Nova* carpenter who was in charge of erecting a hut for the Northern Party, observed that cases had "become weathered and bleached with no markings to indicate the contents" (Davies 1911). In the two weeks it took to erect their own winter quarters, Campbell and Dr G. M. Levick, who preferred fresh air, slept in the stores hut. Over this Campbell rigged a canvas tarpaulin with the edges secured under wooden battens nailed to the outer hut walls. The hut was swept and a solitary nesting penguin they named Percy was evicted but later allowed to share the hut. A latrine was built against the outer west wall, and an anemometer was installed on top of the east wall (Priestley 1914). The hut also became a repository for some of their equipment. Borchgrevink's living hut, after being cleared of snow, was put into use as a living room and later in the year was used for photography and recreation.



*Figure 4:* Southeast corner, stores hut, 1973. Shaun Norman is standing on sleeping platform by east wall and holding harpoon. Northern Party carbide generating cylinder in corner. In centre, case with sledge meters. Area examined is in left foreground. Artefact #23 (canister) extreme left was not removed.

Numerous cases of provisions were commandeered by the Northern Party and filled with ice to construct an ice house, the base of which is still recognisable in a swale 10 m south-west of their hut. Other cases from the *Southern Cross* Expedition are scattered across the site, and many are located near Borchgrevink's huts. The contents of most are unrecognisable and the cases have been damaged by wind. Only a small quantity of supplies are stored under bunks or on shelves of the galley in the living hut.

The next visitors to Ridley Beach are thought to have been a party from the icebreaker *U.S.S. Edisto* on 9–10 February 1956, during Operation Deep Freeze 1 (1955–1956). On this occasion, a survey was made for a suitable site where an aircraft homing beacon and a Deep Freeze 2 I.G.Y. (International Geophysical Year 1957–1958) weather station could be located. Supplies and equipment from the early expeditions were scattered over a wide area. Cases examined contained chocolate and ammunition. The party, wet and cold from landing in a heavy surf, made a fire with coal briquettes (United States Navy 1956).

On 14 January 1961, the first New Zealand field party landed on Ridley Beach. A few days later, when a severe storm destroyed their tents, it was necessary to remove ice from the living hut for accommodation. After 82 hours and with the hut only half cleared, they moved in. A further 68 hours' work was required before it was completely free of ice. The floor of the stores hut was a frozen assemblage of boxes, board fragments and other artefacts. An axe and frypans, possibly associated with the Northern Party, still hung from nails on the east wall. Other utensils had been placed on boards below, perhaps to drain following cleaning, or by some later visitor. Two boards located near the centre of the hut, one attached vertically to the floor and the other mounted horizontally, suggest that a partition had been erected within the hut (Fig. 3).

## PREVIOUS INVESTIGATIONS OF THE STORES HUT

When the second New Zealand field party camped on Ridley Beach between 5 and 19 February 1973, extensive corrosion was noted on many artefacts (Cairns and Norman 1973). Emergency repairs were undertaken on the living hut, and a start was made on clearing the floor in the stores hut (Fig. 4). A number of artefacts were located. They included a Munro cup counter anemometer and the stencilled packing case lid, with dog logo, for an H.M.V. Gramophone, both associated with the Northern Party, and an iron harpoon head. Some items were subsequently deposited in the Canterbury Museum. The brass anemometer, although corroded, was in remarkable condition as a result of protection by ice. However, iron artefacts such as the harpoon and knife blades, which had been exposed to sea salt present as an aerosol and in spray during storms, were very corroded.

In the course of listing artefacts during Canterbury Museum's Cape Adare Expedition from 9 January to 15 February 1982, an examination was made of the 6m<sup>3</sup> frozen mass on the floor (Harrowfield 1982). An 1899 expedition Smith's sledge meter was transferred from an open packing case to the living hut. No attempt was made to excavate the deposit. Other artefacts moved for protection to the living hut included half a man-hauled sledge (1911), a chair (1911) complete in 1961, a hessian dog coat with red cotton braid trim (1899) and two blades for improvised boat paddles (1911?).

On the basis of wind tunnel experiments, deposition and accumulation of beach sediment and penguin guano over the floor in the southeast corner was shown to be caused by wind vortices within the building during gales from the east-south-east and south-east (Harrowfield 1984).

## ARCHAEOLOGY

When the Antarctic Heritage Trust Expedition visited Cape Adare from 31 December 1989 to 4 February 1990, a report on the condition of the historic huts was requested. It was determined that a full assessment of the stores hut could not be undertaken unless the floor, which was a frozen mass of timber, artefacts and sediments, was completely cleared (Fig. 5). In view of the remoteness of the area, the fact that a further visit was unlikely for perhaps another ten years, and the deteriorating condition of the building and artefacts, an approach was made to the Trust about what action should be taken. The instruction to excavate the floor was received by radio from the Trust via the Senior New Zealand Representative at Scott Base. The instruction was also given to return any artefacts recovered to New Zealand for conservation.

This work had not been specified in the expedition's directive and without proper equipment the party had to make do with available equipment or improvise. Tools consisted of a carpenter's hammer, 1 cm chisel made on site from a T-hinge, two kitchen knives, pocket knife with spike, serving spoon, hearth brush, spade, and a 4 m tape. After compiling a floor plan of visible artefacts, the method was to work down through the deposit, isolating and describing each item. This method was applied on the remains of Bower's stores annex at Scott's Hut, Cape Evans, Ross Island by Ritchie and Cross in 1987–1988 (Ritchie 1988) and in the pony stables by Ritchie in 1988–1989 (Ritchie 1989a, 1989b). The following summer, Fyfe decided against continuing the excavation of the artefact-rich stable bays, concentrating instead on removal of 2-m-high ice within the 'corridor' of the stables against

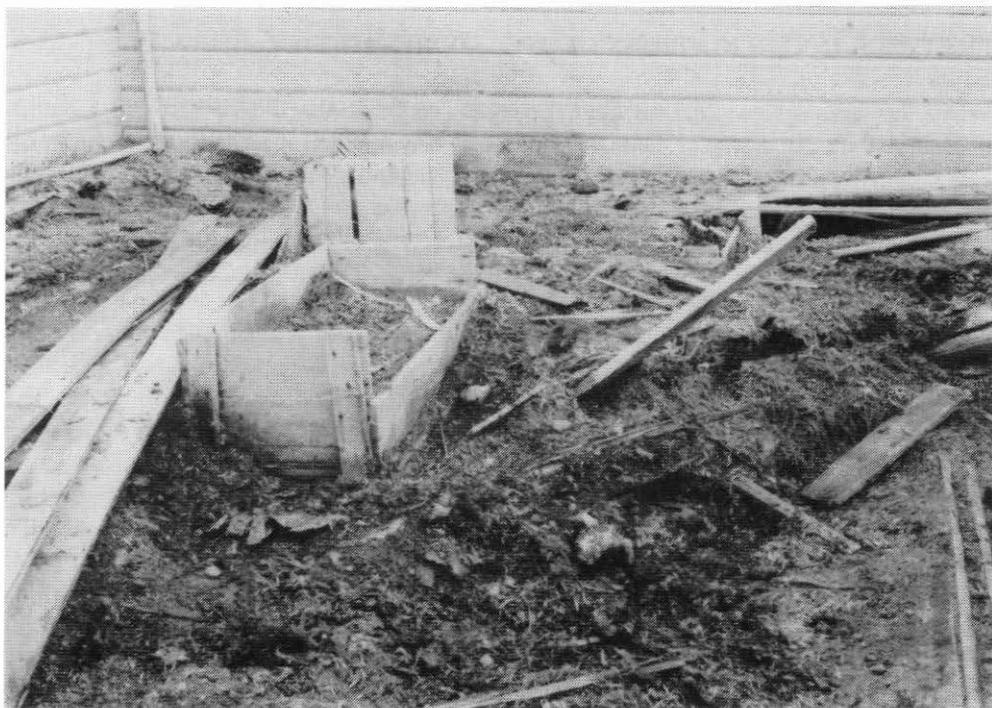


Figure 5: View of deposit in corner of hut at commencement of work 1990.

the north wall of the hut proper (Fyfe 1990). Fyfe used the same equipment and technique, that is standard stratigraphic excavation, employed by Ritchie (Ritchie *ibid.*). The 'sterile' frozen meltwater, ice and snow overburden were removed, thus enabling egress through the stables and preventing further ice build-up on the adjacent interior wall of the hut (Fyfe *ibid.*). Using percussion tools, blocks of ice were systematically removed. Artefacts and features of interest were carefully recorded at the same time. Where a solitary item was encountered and was prone to damage by the percussion tool, it would be removed within a block of ice and allowed to thaw outside. The same method had been applied by the restoration party which removed ice from within the hut in 1960–61 (Quartermain 1961). However, at Cape Adare, equipment necessary for excavation, such as the powered percussion tools used at Cape Evans, was unavailable.

TABLE 2  
ITEMS RECOVERED DURING THE EXCAVATION OF  
BORCHGREVINK'S STORES HUT

Items marked + were returned to New Zealand for conservation. The date shown refers to the probable expedition with which artefact(s) were associated.

#1 Sleeping platforms consisting of 120 mm x 12 mm Tongue and Groove and match-lining boards placed on cases and 'interwoven' at southeast corner of hut. Platform along east wall had six loose boards with snapped ends on top. At 35–40 cm above floor level (1911).

#2 Six cases, each with two completely corroded tins of bulk pack decomposed Spratt's dog food. Cases each 54 x 37 x 35 cm made with boards 10–12 cm thick. Boards badly split from water freezing within the wood and corroding of nails. Case ends stencilled in black:

Spratts Patent Limited	Spratts Patent Limited	Spratts Patent Limited
Fish and Codliver Oil	Fish and Meat Fibrine	Vegetable
Vegetable	Vegetable	Cod Liver Oil
Dog Cakes	Dog Cakes	Dog Cakes
with Beetroot	with Beetroot	with Beetroot
Trade X Mark	Trade X Mark	Trade X Mark
London	London	London

All cases frozen to the floor. Two cases in northeast corner (\* on Fig. 7), also labelled 'The Military Equipment Stores and Tortoise Tents Company Limited' (1899).

#2a Case containing decomposed Spratt's dog biscuits. Dimensions as in #2 (1899).

#3 Empty stores case. Rope handles at end. Measuring 62 x 44 x 35 cm. Contained a 1.5 cm thick ribbed pad of woollen felt folded up at ends and sides. Case stencilled 'JAEGER' in black, one end. Jaeger is the name of a manufacturer of woollen goods in England who supplied most of the early expeditions to 1917 (probably 1899).

#4 Case containing two Smiths distance measuring meters for sledges. Measuring 94 x 40 x 50 cm. With two crudely painted green stripes around case and stencilled in black with 'The Military Equipment and Tortoise Tents Company Limited'. Meters packed in straw and fastened in the case by rope and strips of finished wood. Meters calibrated to 60 miles (geographic) in wooden cases with dovetailed joints. Brass components completely corroded

(heavy corrosion to zinc and other metal parts). Fragments only left of two small cycle wheels possibly with solid tyres (1899) +.

- #5 Zinc lined wooden case with fragments of asbestos cover on top. Measuring 63 x 43 x 25 cm. End stencilled 'This case contains 24 1 lb [unreadable - possibly Cocoa] Fry's Concentrated'. Contained a quantity of .45 calibre Martini Henry cartridges in paper packets labelled

10 cartridges  
Ball  
Martini Henry  
Rolled Case  
manufactured by Ely Bros Ltd London

Cases corroded. Good examples may be in the matrix which was not thawed out. Small numbers of paradox (12 gauge) lead bullets and some short lengths of asbestos cord about 1.5 cm diameter on top (1899).

- #6 Venesta (plywood) case containing tins of Bell & Co. matches and loose bullets which appeared to have spilled from #5. Dimensions of case 60 x 36 x 26 cm (1911).
- #7 Empty wooden case. No markings. Dimensions 11 x 60 x 30 cm.
- #8 Case containing wood wool packing, and a blown glass sphere (#8a) 140 mm diameter. Part broken off at base. Possibly a flask or other scientific apparatus. Case dimensions 78 x 38 x 25 cm.
- #9 Empty wooden case 50 x 36 x 26 cm deep. Resting on part of a glass photographic plate (#29).
- #10 Wooden case containing 58 tall, 95 x 75 cm round tins with rolled over ends, of curry powder (still with strong aroma). Some fragments of hemp cord, a white glazed earthenware pot (#26) on top, and a small tin with press fit lid. Tins all corroded and labels barely decipherable. Paper wrapper 'C & E Morton. J.T. Morton. Currie Powder'. Case dimensions 50 x 43 x 22 cm deep. On side in blue 'R & M Co.' (1899. Refer Table 1).
- #11 Wooden case measuring 30 x 33 x 40 cm on end. Hessian lined and filled with straw to half way level. Ice-filled and not thawed out before departure. Left beside east wall at northeast corner of hut. Stencilled in black '[undecipherable] & J/J Co, Capetown' and 'J. Hill & Town'. The *Terra Nova* called at Cape Town on its voyage to Lyttelton, in 1910 (1911).
- #12 Remains of venesta case (1911).
- #13 Collapsed venesta case 56 x 40 x 27 cm containing tins of Bell & Co wax vesta matches. Description on tin not recorded. Tin plate in reasonable condition but corroded at edges. Case stencilled '500 x 360 mm x 330 mm 12 tins wax matches'. End of case also stencilled in black with 'BAE' (in triangle) over 'Shore Party 1118' and over top of BAE in blue pencil, 'Eastern'. The Eastern Party, when a landing was not made in King Edward VII Land, then became known as the Northern Party. This case has been repacked. It originally contained fish paste, potted meats, chutney, pickled onions, salad oil, etc. (1911).
- #14 Pair of short black leather boots 36 cm tall with pullup tabs inside. Wet and misshapen and with stitching rotted in places. Recovered from top of platform boards in southeast corner

of hut at 62 cm above floor. The only examples known from the Ross Sea region historic sites (1899?) + (Fig. 10).

- #15 Zinc plated blubber melter 37 x 17 x 30 cm with brass tap 5.5 cm long and brass tube 43 cm in length thought to be connected to #16. With steel ring 20.5 cm in diameter designed for attachment to chimney of blubber stove. Lying on floor. Left in Borchgrevink's living hut (1911).
- #16 Zinc container associated with #15. Collapsed following thawing of ice inside. With brass spout and cap, and screw tap. Steel clamp 11.5 cm diameter for attachment to blubber stove, stove hot plate ring, and fragments of charred asbestos cord. Dimensions of zinc container 28 x 20 x 12 cm deep. Recovered from floor (1911).
- #17 Two fire box tiles each 28 x 20 cm with some rust staining, and eight cast iron fire bars each 28 x 61 cm. Possibly associated with blubber stove. Recovered from floor (1911?).
- #18 Body of Adelie penguin. Appeared to have died from natural causes. On floor.
- #19 Body of skua. On floor, under straw.
- #20 Heavy canvas rifle scabbard, stitching reasonably intact (Fig. 10). The only example known from the historic sites. At 16 cm above floor level. Borchgrevink's party was equipped with revolvers, double barrelled 12 gauge paradox guns, and Lee Metford .303 and Martini Henry .450 calibre rifles. The Northern Party had a miniature (probably .22 calibre) rifle only. A box of miniature rifle targets is outside their hut. (1899) +.
- #21 Jaeger ? brown blanket 162 x 210 cm with 2 cm dark strips at 10 cm from one end and at 16 cm from the other. Some rust stains and slight tears. The only example known from the historic sites. Recovered from 8 cm above floor level (1899) +.
- #22 Blue glass medicine or photographic chemical bottle. Broken and returned to New Zealand for repair. In ice on the floor (1899?) +.
- #23 Zinc plated canister with press fit domed lid in a rotted remnant of woven cotton bag with webbing strap on each side for securing lid to canister. With the exception of the inner edge of the lid, the interior is in quite good condition. Exterior corroded. Overall dimensions 28 cm tall, 25 cm wide.

Inside are utensils, some individually wrapped in brown paper (Fig. 9). These consist of three enamel plates, white with blue edge—three each 200 mm diameter. Some corrosion where the enamel is missing, but in better condition than any recovered elsewhere on the site. Two further plates of same colours, measuring 210 mm, branded with paper label 'English Make' and 'Anglo'. Nickel ? plated frypan 200 mm diameter with handle designed to fold into pan. Very corroded on outer surface and in part of inner edge but remaining plating in mint condition. Two plated cooking containers with pressfit lid, folding handles on one side and brass badge of the 'Military Equipment Store and Tortoise Tents Company'. One with three drinking vessels with folding handles and three small film canister size containers with lids, possibly for salt etc. Plating in poor condition. The other containing two forks each badly corroded and bone (horn?) handles split (Fig. 9), and two teaspoons, one in mint condition. Both spoons stamped 'D & A Bengal Silver'. This artefact was located standing upright on the floor (1899) +.

- #24 Corroded steel tube presumed to be part of acetylene lighting system used by the Northern Party. Located on the floor with some rope underneath (1911).
- #25 Remnant of a black windproof garment or overcoat? One bone button. Badly fragmented by ice. Located in remains of venesta case with green stripe around middle. A black sulphurous smelling chemical had spilled around this case. Not thawed out.
- #26 White glazed earthenware pot with lead foil cap over a cork plug. 70 x 65 mm. Contents not identified. Located in top of case #10.
- #27 Fragment of Union Jack. Colours have run and material rotted. A part from one of 500 flags (71 x 46 cm) taken south. Two good examples in Canterbury Museum, Christchurch, were souvenired during Scott's National Antarctic (*Discovery*) Expedition 1901–1904. Located 30 cm above floor level (1899).
- #28 Willow walking stick 100 cm long. Wood wet and frayed on surface (wood fur).
- #29 Piece of glass photographic plate. Recovered on the floor beneath #9.
- #30 Small section of broom handle. Located on the floor.
- #31 Wooden case measuring 48 x 42 x 20 cm. Stencilled 'VVO'. Possibly a liquor case. Boards for 'Scotch Long John Whisky' located outside stores hut. Borchgrevink's party had a range of beverages including cognac, whisky, brandy, rum and champagne. Less was taken by the Northern Party whose drinks included a small amount of champagne, port, sherry and whisky.
- #32 Wooden case measuring 52 x 37 x 38 cm.
- #33 Wooden case measuring 58 x 40 x 37 cm. Stencilled 'BEEHIVE' on one end.
- #34 Wooden case measuring 50 x 36 x 26 cm.
- #35 Three badly corroded cooking utensils consisting of a steamer, stew pot, and badly corroded kettle. These were in good condition in 1961. Considerable change noted since 1982 (1911).
- #36 Cast iron blubber stove (Fig. 9). Top 23cm<sup>2</sup>, base 34cm<sup>2</sup>, 43cm sides. An identical stove is in the stables at Cape Evans. Designed and built in New Zealand by Shacklock. Very corroded. Moved from stores hut to porch of living hut (1911).

---

Loose timber, parts of boxes, a large sledge (270 x 70 x 20 cm), and up to 27 cm of grit, pebbles, penguin guano and feathers, were removed to expose a layer 3–7 cm thick, subjected in summer to regular freezing and thawing. A sheet of 125 cm black polythene was then used to melt the surface. This technique was first tried on Ross Island in 1977–1978 but then with only limited success (Harrowfield 1978). Over three and a half hours, the ambient air temperature recorded within the hut rose from 0.75 to 1.5°C, while over the same period, the temperature beneath the polythene, which was sheltered from the wind and had the benefit of a fine day, reached 22°C. A combination of warm water (a technique used on Arctic sites), solar radiation, and the hammer and chisel, although slow, enabled the artefacts, including a second Smith's sledge meter, to be isolated (Fig. 6). Most wooden cases were frozen to the floor.



Figure 6: Excavating sledge meter.

As artefacts were located, following removal of the surrounding matrix, their positions were recorded on the floor plan (Fig. 7). Some items were wrapped in polythene and placed outside to thaw slowly in the 24 hour sunlight. Leather, fabric and wood artefacts were sprayed with a solution consisting of 10% Thymol crystals dissolved in methylated spirit to discourage fungi and algae. A selection of the artefacts recovered (Table 2) were packed in quilted dacron and bubble plastic, and removed to Scott Base for return to New Zealand. They are now held in a deep freeze in Christchurch and await treatment.

Most of the artefacts consisted of provision boxes, some items of clothing and equipment. A quantity of ammunition was present. A bizarre find was a skua, which appeared to have been trapped, perhaps when examining the body of a penguin nearby, although diaries record that many were shot by men of the 'heroic era' (1895–1917) for food and specimens. The artefacts encased in ice were well preserved. The preservation quality of constant below zero temperatures on artefacts is exemplified by a zinc-plated canister from the 1899 expedition containing an enamel plate, fry pan, and teaspoon individually wrapped in brown paper, in almost new condition. Only one item referred to in Borchgrevink's list (Table 1), a case of curry powder, was present.

Of particular interest was the presence of boards placed on cases along the east and south walls. It is suggested these were the sleeping platforms used in 1911 by Campbell and Levick while their winter quarters were being constructed a few metres north of Borchgrevink's huts. In the south-east corner, some regularly placed cases (#2, 4, 9 in Fig. 7) suggest partitioning of this part of the hut for warmth. This was similar to the partitioning in mid August 1908 of Scott's 1901–1904 expedition hut at Hut Point in McMurdo Sound,

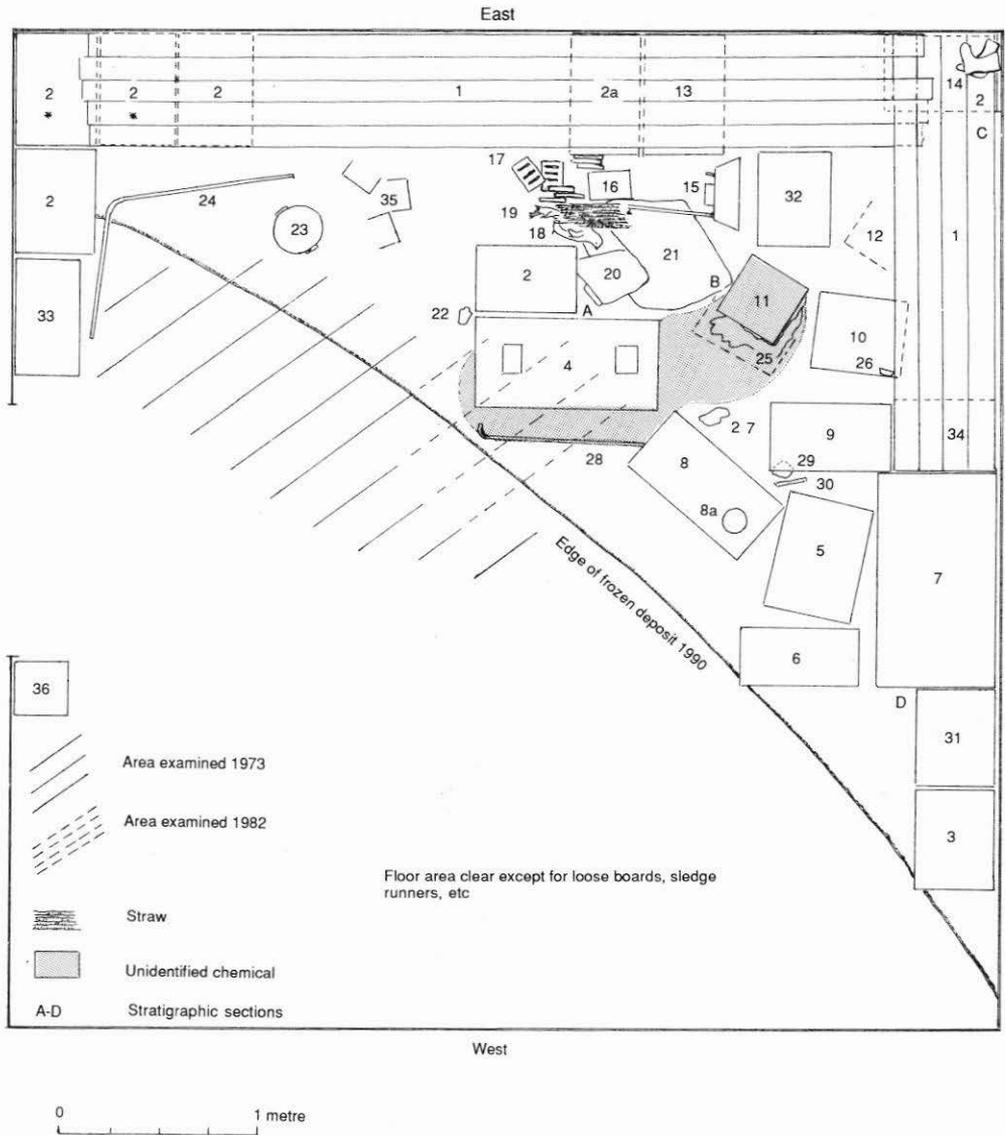


Figure 7: Plan of stores hut interior showing area excavated, January 1990.

by members of Shackleton's British Antarctic (*Nimrod*) Expedition 1907–1909. Cases of biscuits and meat were used to construct “another hut inside the main one, so that the quarters would be a little more cozy” (Shackleton 1909). In 1990, no evidence remained of the structure within the stores hut which had been photographed in 1961 (Fig. 3).

Some cases forming the partition had collapsed inwards or outwards because of wind vortices within the hut. The partitioned area may have been heated during the hut's occupancy in 1911 and although some stove fittings appeared to be *in situ*, the exact

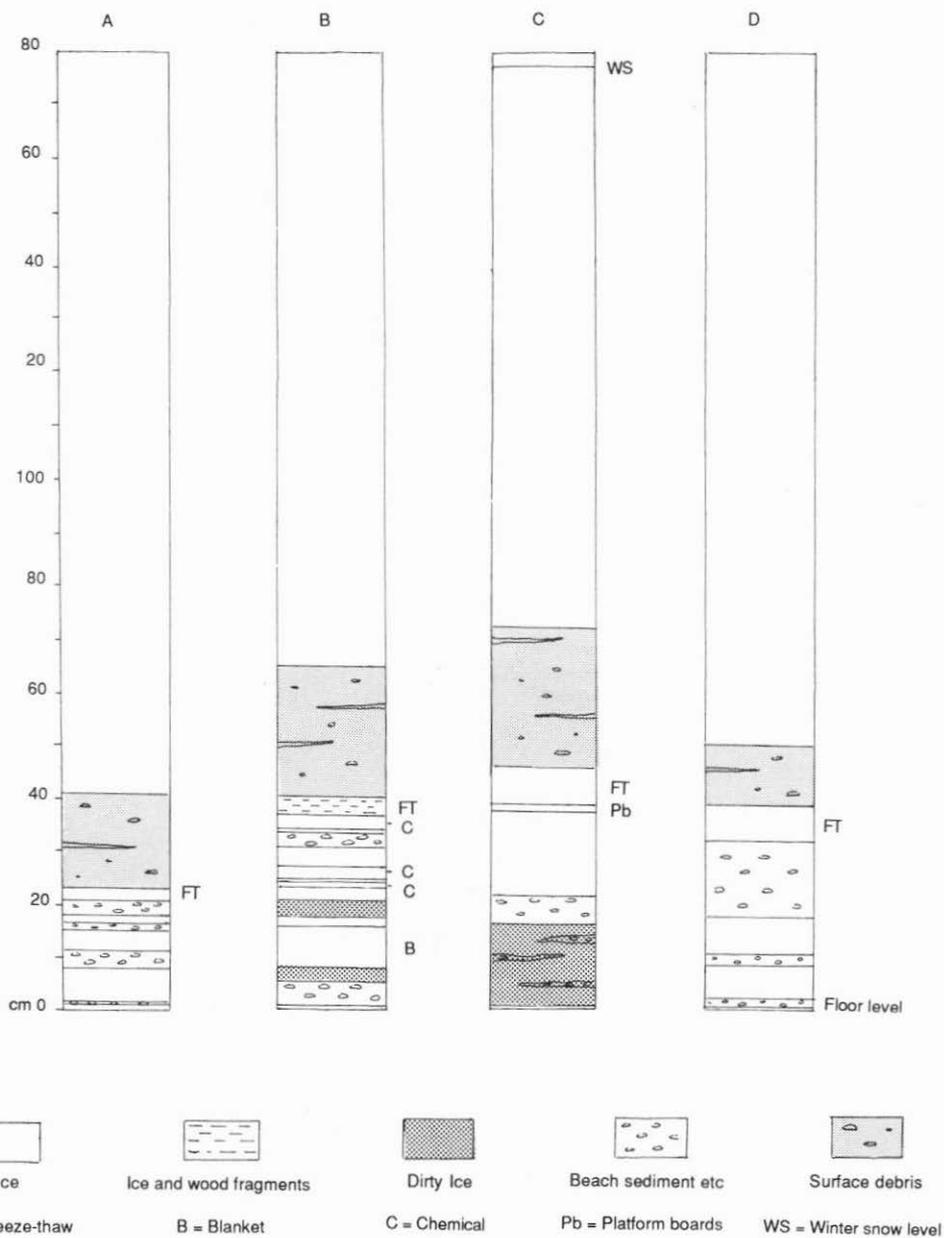


Figure 8: Stratigraphic sections, January 1990.

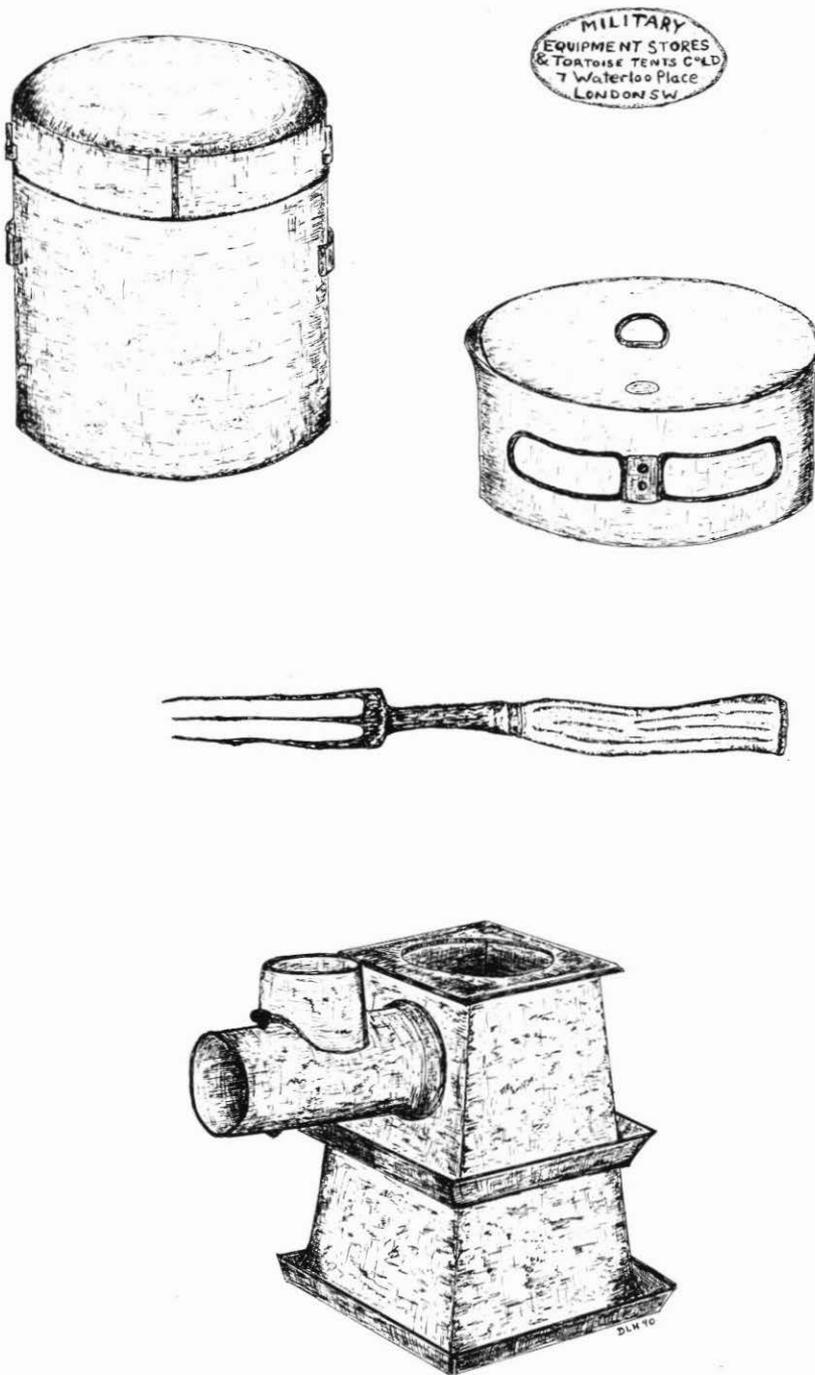


Figure 9: Canister with utensils (1899) and cast iron blubber stove (1911).

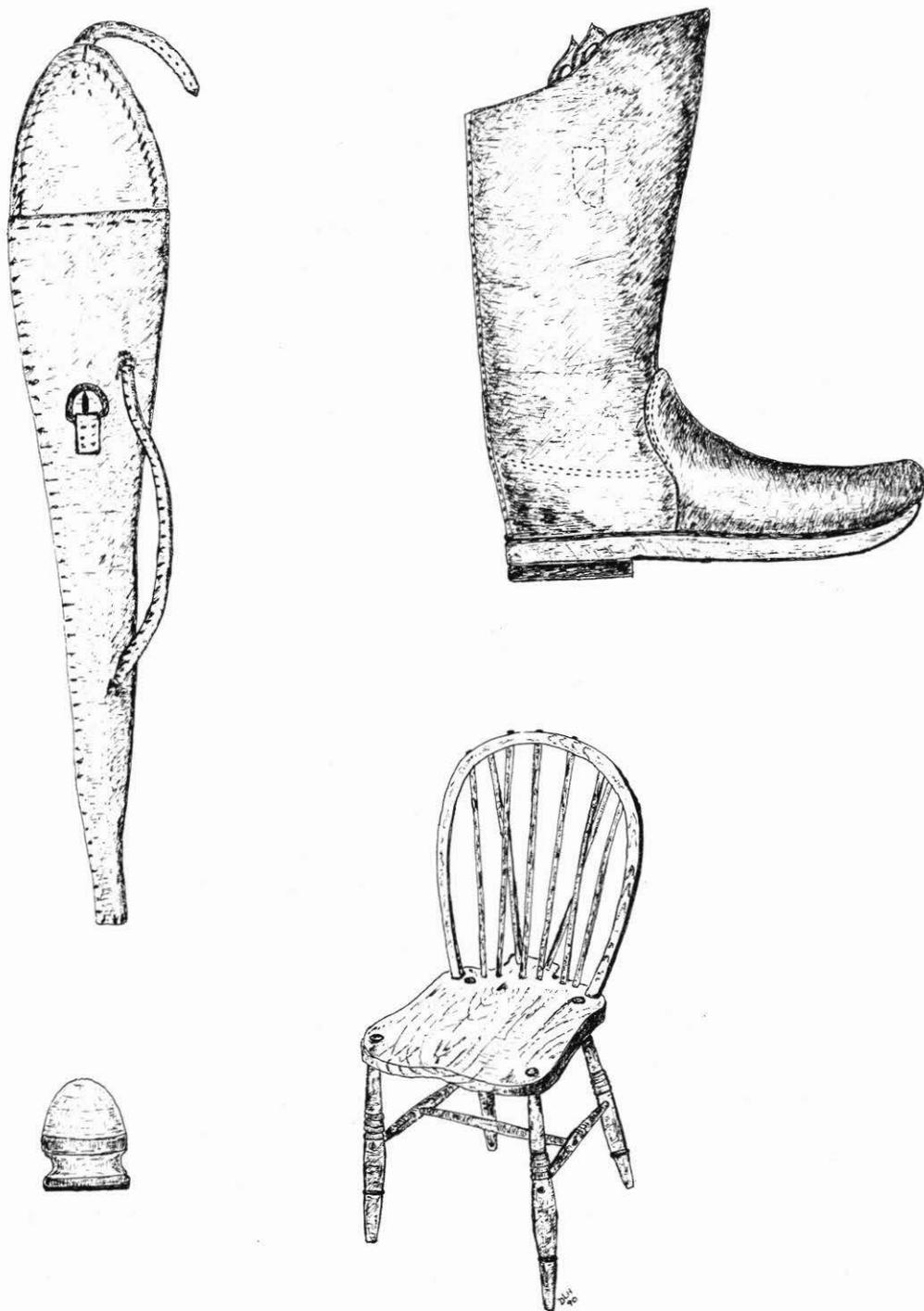


Figure 10: Canvas rifle scabbard, leather boot, paradox bullet (1899) and bentwood chair (1911).

position of the small cast iron blubber stove is not known. A folded blanket confirms that this part of the hut was used for sleeping.

The stratigraphic sections recorded (Fig. 8) consisted of layers of ice and wind deposited feathers, guano, beach sediment and wood fragments. The latter are blown in by late summer and autumn storms while ice layers reflect heavy snow years. Once provision cases became frozen to the floor, they served to trap snow. With the exception of a dark sulphurous chemical which appeared to have originated from box #11 (Fig. 7), only five meaningful strata could be distinguished. Beneath surface debris of frozen snow, beach sediment, wood and other organic material, a freeze-thaw layer consisting of a semi-frozen mass of ice with sand, pebbles, wood fragments, etc., was present. This ranged in thickness from 3–7 cm. The ice layers in the deposit were generally hard and crystalline in texture.

Photographs indicate that with the exception of the south-east corner, an average of only 1–2 cm of sediment and organic matter has accumulated since 1961. Layers of beach sediment, feathers and guano down to floor level may be attributed to major storms from the east-south-east in particular. No evidence of old penguin nests was found. Blocking up the entrance in 1973 has prevented birds entering the hut. The depth of 1989 snow accumulation in the south-east corner could be distinguished by salt encrustation on the walls at 134 cm above the freeze-thaw layer.

The excavation was completed in fine weather over three days and, once the floor was cleared, the true extent of damage due to ice beneath the hut was apparent. The floor beneath the deposit was in worse condition than the remainder. Some floor boards were split and raised up to 8 cm above the exposed part of the floor, which also had a fall of 9 cm at the north-east corner. The south wall, and particularly the east wall, were bowed outwards at the base, 2–3 cm from the floor. This was also attributed to ice beneath the hut and the presence in the east wall of only one strengthening rod. With the hut cleared, storage was provided for artefacts collected from around the site, including the bow of a whale boat blown out to sea in a storm on 20 March 1899 and then smashed on the beach. It was later placed by Borchgrevink's party near the huts, upright and guyed, perhaps as a latrine.

One unfortunate aspect of the work was the complete disintegration of several boxes of bulk pack 1899 expedition Spratts dog food within hours of removal from the ice. This was a problem not encountered during the excavation by Ritchie and Cross of Bowers stores annex at Cape Evans in 1988, when Colmans flour boxes recovered remained intact. However, the wood was brittle and would break if levered (Ritchie pers. comm.). Cases of New Zealand butter, located when the ice-filled stables were cleared at Cape Evans in January 1989, also remained intact. Although the type of timber used and corroded nails may have been contributing factors in their collapse, water had penetrated the boards, freezing and splitting the wood. When they thawed, the cases and decomposed contents fell to pieces. Only stencilled case boards were retained. These were left in the stores hut and remaining pieces were placed in the porch of the 1911 expedition hut. No instance of this problem is reported elsewhere, although Janes (1982) notes that wood recovered under such conditions requires slow thawing to enable the gradual reduction of moisture content. Defibring of some wood surfaces, presenting a fur-like appearance, was noted on some cases in the ice. Hughes (1986, 1988) first recognised this problem at Mawson's Hut, Commonwealth Bay, where high humidities have been recorded. Cases were exposed and as a result of moisture, high humidities and nutrients from the guano, some algae was growing. A small corroded zinc container thought to be associated with the blubber melter also collapsed following the melting of ice inside. Janes (*ibid.*) who excavated a 25 x 9 m unroofed storehouse on Dealy Island in Arctic Canada, has pointed out that organic

materials can deteriorate rapidly when they are removed from their frozen environment, and considers *in situ* stabilisation is the only sensible alternative.

## CONCLUSIONS

Of the artefacts recovered from this excavation, only a few were considered to be *in situ* from 1911. Many comprised examples not previously represented at the historic sites in the Ross Sea region, and the majority could be assigned with certainty to either the 1899 or the 1911 expeditions. The preservation quality of the ice, which completely encased many artefacts, was evident. The stratigraphy reflected various storm events of the past 79 years. Of particular interest were the sleeping platforms and evidence of probable partitioning and heating within the hut during its occupancy by the Northern Party.

The excavation was completed during the last few days of the five week expedition, which also attached new cladding to the roof of the 1899 expedition living hut (Harrowfield 1990a, 1990b). In retrospect, the archaeological work should probably not have been undertaken. Not only was a materials conservator not present, but specialised conservation equipment, such as insulated containers, freezer packs, and vapour phase inhibitors to prevent metals deteriorating, was not available. In contrast to the situation at some historic sites in the Ross Sea region, which are receiving increasing numbers of visitors, most of the artefacts in the stores hut were in little danger except from exposure to the elements. One alternative would have been to leave the frozen assemblage *in situ* and mount a return visit in the near future to install an insulated floor above the deposit, as was done at Kellett's storehouse on Dealy Island (Janes *ibid.*). Another would have been to delay excavation of the deposit until a conservator with appropriate equipment and further knowledge on excavating frozen historic sites was available.

To date, because of financial and logistic constraints on the New Zealand Antarctic Research Programme, professional conservators have not taken part in any field events involving historical archaeology. It must be recognised that it is impossible to remove artefacts from a stable environment such as ice when no provision has been made to safeguard against deterioration and, as Arnold (1982) states, such sites are 'a non-renewable resource'. Since completion of the work at Cape Adare, a new five year conservation plan has been prepared by the Antarctic Heritage Trust (Cochran *et al.* 1990). The Trust recognises that artefacts encased in ice are apparently only deteriorating slowly, and that those at present buried are not a priority. When archaeological excavation takes place, a materials conservator should be present and any artefacts recovered must remain in Antarctica. It should be noted that Karel Peters and Lyn Campbell, materials and paper conservators respectively, began a detailed assessment of artefacts at the Ross Island sites in 1990-91, and Jack Fry (conservator) and Chris Cochran (conservation architect) have previously been to Antarctica.

## ACKNOWLEDGEMENTS

I would like to thank the many sponsors and DSIR Antarctic, the Antarctic Heritage Trust, United States National Science Foundation, the United States Coast Guard, and the Australian Antarctic Division for making it possible to revisit Ridley Beach, and Gerry Turner, Russell Skerten and Peter Selwyn for assistance with this work. Dr Neville Ritchie of the Department of Conservation kindly read the paper in draft, and Sherelle King of DSIR Antarctic assisted with the typing.

## REFERENCES

- Arnold, C. D. 1982. Archaeology in the Northwest Territories. *Northern Perspectives* 10 (6): 1-10.
- Bernacchi, L. 1901. *To the South Polar Regions*. Hurst and Blackett, London.
- Borchgrevink, C. E. 1901. *First on the Antarctic Continent*. George Newnes, London.
- Cairns, L. and Norman, S. 1973. Cape Adare Expedition. Report to Antarctic Division, DSIR, on Historic Hut Restoration and Site Inspection, 13 pp.
- Cochran, C., Fyfe, R., Harrowfield, D. L., Norris, B., Peters, K. and Ritchie, N. 1990. Historic Huts Ross Sea Region Antarctica. Conservation Plan. Antarctic Heritage Trust, Christchurch. 113 pp.
- Colbeck, W. R. 1903. Private diary. From Lyttleton Southwards—Antarctic Relief ship *Morning*. Dec. 6, 1902—Mar. 25, 1903. Canterbury Museum, Christchurch.
- Davies, F. E. C. 1911. Diary of the *Terra Nova* Expedition. Canterbury Museum, Christchurch.
- Fyfe, R. 1990. Ross Island Historic Huts: Cape Evans, Cape Royds, Hut Point. Report on Archaeological Field Work and Future Management Considerations for the Antarctic Heritage Trust. 40 pp.
- Harrowfield, D. L. 1978. Historical archaeology in Antarctica. *New Zealand Archaeological Association Newsletter* 21 (3): 95-102.
- Harrowfield, D. L. 1982. Historic Sites in the Robertson Bay Region, Northern Victoria Land, Antarctica. Report to the Canterbury Museum Trust Board and the Historic Sites Management Committee of the Ross Dependency Research Committee. HSMC. 87 pp.
- Harrowfield, D. L. 1984. The Effects of Wind on some Historic Antarctic Huts. *Fram: Journal of Polar Studies* 1 (2): 471-486.
- Harrowfield, D. L. 1990a. Logistic Report to DSIR Antarctic, K282, K013C. 23 pp. and 6 appendices.
- Harrowfield, D. L. 1990b. General Conservation Report—Cape Adare Historic Site, Northern Victoria Land, Antarctica. Report to the Antarctic Heritage Trust. 57 pp. including 8 appendices.
- Hughes, J. 1986. Mawson's Huts Interim Conservation Report Project Blizzard Volume 6. 82 pp.

- Hughes, J. 1988. The problems of preservation in a polar climate: The conservation of Sir Douglas Mawson's huts at Commonwealth Bay, Antarctica. *ICCM Bulletin* 14 (3 and 4): 1-25.
- Janes, R. R. 1982. The preservation and ethnohistory of a frozen site in the Canadian Arctic. *Arctic* 35 (3): 358-385.
- Mabin, M. C. G. 1982. Report on Geomorphological Investigations at Ridley Beach. Ross Dependency Research Committee. 7 pp.
- Priestley, R. E. 1914. *Antarctic Adventure*. T. Fisher Unwin, London.
- Quartermain, L. B. 1961. Huts Restoration Project. Report to Antarctic Division, DSIR. 25 pp.
- Ritchie, N. A. 1988. Report to Antarctic Heritage Trust on Archaeological Heritage Work and Management Considerations. 34 pp.
- Ritchie, N. A. 1989a. Report on Archaeological and Restoration Work and Future Management Considerations for the Antarctic Heritage Trust. 23 pp.
- Ritchie, N. A. 1989b. Polar excavation techniques and archaeology. *New Zealand Journal of Archaeology* 11: 101-115.
- Shackleton, E. H. 1909. *The Heart of the Antarctic*. William Heinemann, London.
- Taylor, R. H., Wilson, P. R. and Thomas, B. W. 1990. Status and trends of Adelie penguin populations in the Ross Sea Region. *Polar Record* 26 (159): 293-304.
- United States Navy 1956. Annex V. *Operation Deep Freeze 1955-1956 Report* pp. 220-221.
- Wilson, E. A. 1966. *Diary of the Discovery Expedition to the Antarctic Regions 1901-1904*. Blandford Press, London.

*Submitted 10 December 1990*

*Accepted 3 April 1991*